Question 1

i) Substitute the values into the formula for compound interest.

Final amount = $P\left(1 + \frac{r}{100}\right)^n$, where P = initial amount, r = interest rate, n = number of years.

P = \$2000, r = 2%, n = 5 years.

$$\text{Total amount} = 2000\left(1 + \frac{2}{100}\right)^5$$

$$= 2000 \times 1.02^5$$

Correct use of formula [1]
Final amount = \$2208.16 [1]
Unrounded answers accepted

ii) Method 1

Find the difference between the original amount and the increased amount.

$$2208.16 - 2000 = 208.16$$

Divide the difference by the original amount and multiply by 100% to find the percentage increase.

$$\frac{208.16}{2000} \times 100$$

Correct method [1]
10.4% (3 s.f.) [1]

iii) Substitute the values into the formula for compound interest, letting the final amount be 2500 and leaving n unknown.

Final amount = $P\left(1 + \frac{r}{100}\right)^n$, where P = initial amount, r = interest rate, n = number of years.

P = \$2000, r = 2%, n = n years.

The question asks for more than so use the inequality >.

$$2000\left(1 + \frac{2}{100}\right)^n > 2500$$

[1]

The value of n can be found by trial and improvement. It may be easier to simplify the equation first.

$$\frac{2000\left(1 + \frac{2}{100}\right)^n}{2000} > \frac{2500}{2000}$$

$$1.02^n > 1.25$$

Try n = 11.

$$1.02^{11} = 1.24337... < 1.25$$

Try n = 12.

$$1.02^{12} = 1.26824... > 1.25$$

Trying n = 11 or 12 [1]
12 complete years [1]

Question 2

Compound interest is where each day the interest is calculated by finding the percentage of the current amount.

Recall the formula for compound interest $A = P\left(1 + \frac{r}{100}\right)^n$.

A is the total final amount.
P is the initial amount,
r is the interest rate.
n is the number of days.

Substitute $P = 200$, $r = 0.0035$, $n = 365$ to find the total final amount after 1 year.

$$200\left(1 + \frac{0.0035}{100}\right)^{365} = 202.5713...$$

[1]

Round US Dollars to 2 decimal places.

$202.57 [1]
It is acceptable to write as 3sf: $203

Question 3

The question describes an increase of 5%, so add 5% to the original 100% and divide by 100 to find the percentage multiplier.

$$(100 + 5) \div 100 = 1.05$$

i) If you know the original amount and you wanted to find the final amount after 2 years, you would multiply the original amount by the percentage multiplier squared.

$$\text{original amount} \times 1.05^2 = 882$$

[1]

For this reverse percentages question you need to work backwards.
Divide the final amount by the percentage multiplier squared to find the original amount.

$$\text{original amount} = 882 \div 1.05^2$$

$800 [1]

As the answer is an exact number of dollars, you don't need to include the 2 d.p.

ii) Substitute different integer (whole number) values for n into the equation 882×1.05^n, until the final amount is greater than $1100.

E.g. $n = 4$

$$882 \times 1.05^4 = 1072.07651...$$

[1]

This answer is just a little bit lower than needed, so try a higher value for n.

E.g. $n = 5$

$$882 \times 1.05^5 = 1125.68033...$$

This has just exceeded the value of $1100.

5 years [1]

Question 4

Work out the number of years between 2018 to 2027.

$$2027 - 2018 = 9$$

Work out the decimal multiplier for the percentage increase each year by adding the percentage change to 100% and dividing by 100.

$$\frac{8.7 + 100}{100} = 1.087$$

Calculate the amount that he will earn in 2027 by multiplying the amount he earns in 2018 by the decimal multiplier raised to the power of the number of years.

$$195600 \times 1.087^9 = 414414.313...$$

[1]

Subtract the amount he earned in 2018 from the amount he earned in 2027 to find the difference.

$$414414.313... - 195600$$

[1]

$$218814.313...$$

$219 000 [1]

Answers of 218814.3...rounded to 4 s f or more will be accepted.

Question 6

Exponential growth means that the percentage increase is applied at the end of each year to the population at that point in time (i.e. not just to the original population)
To increase a number by 1.6 %, we can multiply by 1.016, and this is then applied 20 times in this case
You could also think of this as representing 101.6 % of the amount

$$1.016^{20} = 1.373643891...$$

[1]

1.374 represents 137.4% of an amount, so this is an increase of 37.4 %

37.4 % [1]

Question 5

Calculate the total amount of money in Bryan's bank account after 4 years before he buys the bicycle.

Add the interest rate to 100% as it is an increase and divide the result by 100 to turn it into a decimal.

$$\frac{100+2.1}{100}=1.021$$

Multiply the original amount by the decimal multiplier to the power of the number of years.

$$480\times1.021^4=521.60795...$$

[1]

Subtract the cost of the bicycle from the amount in the bank account.

$$521.60795...-430$$

[1]

$$91.60795...$$

$91.61 [1]

Answers between 91.60 to 91.61 will be accepted.